ATTACHMENT A

CHEMICALS USED AT CHANG FARMS

ATTACHMENT A

CHEMICALS USED AT CHANG FARMS

Usage	Product Name	Chemical Composition	Estimated Usage
Nutrients	P1	Phosphoric Acid (2.0%) Soluble Potash (1.0%) Calcium Carbonate (2.0%)	0.5 gallons per day
	B88	No Longer Used	
Cleaning	F-182A Liquid Chlorinated Alkaline Foam Cleaner	Sodium Hydroxide (5%) Sodium Hypochlorite (1.5%)	1.0 gallon per day
Cleaning	F-48 Liquid Acid Cleaner and Sanitizer	Quanternary Ammonium (7%) Phosphoric Acid (30%) Ethyl Alcohol (2%)	8 oz per day (0.0625GPD)
Cleaning	Super Lime-Sol	No Longer Used	
Cleaning	Powder Bleach	Calcium Hypochlorite	2 lbs/day

ATTACHMENT B

MONTHLY DATA SUMMARY

ATTACHMENT B - MONTHLY DATA SUMMARY JULY 2004 to JUNE 2006

	Flow (GPD)		Chlorine Residual[2] (mg/l)		TSS[3] (mg/l)		BOD[4] (mg/l)		Total P (mg/l)		Total N (mg/L)		Fecal Coliform (cfu/100 ml)		pH (S.U.)	
	Monthly Average	Daily Max	Monthly Average	Daily Max	Monthly Average	Daily Max	Monthly Average	Daily Max	Monthly Average	Daily Max	Monthly Average	Daily Max	Monthly Average	Daily Max	Monthly Average	Daily Max
July-04	95,333	100,000	0	ND[5]	7.7	9.0	171	360	9.7	20	10	11	<10 - TNTC[6]	TNTC	No data	
August-04	99,667	107,000	0.1	0.16	9.6	10.0	13	15	3.8	6.1	11	12	169,000	263,000	No data	
September-04	91,800	105,000	0.025	0.1	10.5	13.0	17	19	3.9	10.0	11	12	123,000	310,000	No data	
October-04	99,250	107,000	0.23	0.72	11.8	16.0	17	24	2.9	4.4	12	13	13,005	34,000	No data	
November-04	156,946	216,864	0.53	0.81	9.3	11.0	16	19	1.8	2.9	12	13	11,667	15,000	7.0	7.0
December-04	117,428	128,491	0.41	0.86	12.7	15.0	20	22	1.2	1.7	13	14	4,743	18,000	6.9	7.0
January-05	140,731	162,994	0.1	0.22	15.8	23.0	24	29	0.5	0.6	10	14	46,250	120,000	7.2	7.3
February-05	159,523	159,523	0		18.0	18.0	28	28	0.4	0.4	13	13	700	700	7.2	7.2
March-05	143,217	159,523	0.018	0.09	14.4	22.0	24	32	1.0	1.9	12	13	<100 - TNTC	TNTC	7.2	7.3
April-05	157,637	193,277	0.03	0.12	15.0	20.0	24	29	1.1	1.7	12	13	162,000	430,000	7.1	7.3
May-05	164,038	176,789	0	ND	12.8	16.0	19	24	1.1	1.5	10	11	202,775	780,000	7.0	7.2
June-05	143,983	151,920	0	ND	10.2	14.0	25	61	1.0	1.6	10	11	60,830	300,000	7.2	7.2
July-05	147,352	156,658	0.038	0.05	8.5	14.0	14	16	0.5	0.6	10	10	900	3,000	7.3	7.5
August-05	166,702	186,811	0.025	0.05	13.5	16.0	27	27	1.3	1.4	12	14	200	400	7.3	7.3
September-05	167,803	177,437	0	ND	11.8	16.0	20	27	1.4	2.3	12	12	10,250	19,000	7.4	7.5
October-05	166,896	172,512	0.025	0.05	9.5	11.0	15	21	1.8	2.2	12	12	6,000	10,000	7.3	7.4
November-05	147,974	153,605	0	ND	6.5	13.0	18	29	1.4	2.2	14	16	TNTC	TNTC	7.1	7.1
December-05	184,884	203,677	0	ND	8.0	17.0	19	30	0.7	1.4	12	15	686,333	1,800,000	7.1	7.2
January-06	157,455	318,904	ND	ND	9.5	10.0	15	14	1.1	1.6	11	12	3,000	3,000	No data	
February-06	159,600	211,797	ND	ND	8.3	9.0	14	15	0.7	0.9	10	11	no data		No data	
March-06	121,000	300,259	ND	ND	3.0	6.0	26	33	0.8	0.8	11	12	no data		No data	
April-06	128,971	154,849	ND	ND	10.3	11.0	29	47	1.2	1.5	9	9	no data		No data	
May-06	137,423	205,950	ND	ND	6.0	6.0	14	14	ND	ND	10	10	1	1	No data	
June-06	142,049	176,002	ND	ND	ND	ND	ND	ND	1.5	1.5	9	9	>200	>200	No data	
Minimum	91,800	100,000	0	ND	3	6	13	14	0	0	9	9	1	1	6.9	7.0
Maximum	184,884	318,904	0.53	0.86	18	23	29	61	4	10	14	16	TNTC	TNTC	7.4	7.5
Average	141,569	174,452	0.064	0.14	11	14	20	26	1	2	11	12			7.2	7.3

NOTES:

1. Flow measurements recorded in late 2005 and early 2006 are suspect due to foaming problems in the measurement flume.
2. Residual Chlorine detection limit is 0.05 (source: 2/23/06 telephone call to M. Krcmarik)
3. Total Suspended Solids (TSS) detection limit is 5 mg/l (source: 3/1/06 email from M. Krcmarik)
4. Biochemical Oxygen Deman (BOD) detection limit is 3 mg/l (source: 3/1/06 email from M. Krcmarik)
5. ND = not detected
6. TNTC = too numerous to count
7. Anomalous data from July 2004 not included in statistical analysis

ATTACHMENT C

TSS AND BOD STATISTICAL ANALYSIS

CHANG FARMS
PERMIT LIMIT DERIVATIONS

BOD Concentration Loading

Daily Maximum Limit Derivation

u_y = Avg of Nat. Log of daily discharge (mg/l) =	2.89207
σ_y = Std Dev. of Nat Log of daily discharge =	0.35788
$\Sigma (y_i - u_y)^2$ =	8.32508
k = number of daily samples =	66
σ_y^2 = estimated variance = $(\Sigma[(y_i - u_y)^2]) / (k-1)$ =	0.12808

Daily Max Limit = exp (u_y + 2.326*σ_y)

Daily Max Limit = 41.45 mg/l
(Log normal distribution, 99th percentile)

Average Monthly Limit Derivation

Number of samples per month, n =	3.00
E(x) = Daily Avg = exp(u_y + 0.5 σ_y^2) =	19.22309
V(x) = Daily Variance = exp(2u_y + σ_y^2) * [exp(σ_y^2) - 1] =	50.49285
σ_n^2 = Monthly Average variance = ln{ V(x) / (n[E(x)]^2) + 1} =	0.04454
σ_n = Monthly Average standard deviation = σ_n^2^(0.5) =	0.21105
u_n = n-day monthly average = ln(E(x)) - 0.5σ_n^2 =	2.93384

Monthly Average Limit = exp (u_n + 1.645*σ_n)

Monthly Avg Limit = 26.60 mg/l
(Log normal distribution, 95th percentile of average monthly values)

Source: EPA 1991, *Technical Support Document for Water Quality-base Toxics Control,* Appendix E - Lognormal Distribution and Permit Limit Derivations, EPA/505/2-90-001

CHANG FARMS
PERMIT LIMIT DERIVATIONS

Total Suspended Solids (TSS) Concentration

Daily Maximum Limit Derivation (some measurements < detection limit)

D = detection limit =		5 mg/l
u_y = Avg of Nat. Log of daily Discharge (lbs/day) =		2.43313
$\Sigma (y_i - u)^2$ =		6.04780
k = number of daily samples =		70
r = number of non-detects =		6
σ_y^2 = estimated variance = $(\Sigma[(y_i - u_y)^2]) / (k-r-1)$ =		0.09600
σ_y = standard deviation = square root σ_y^2 =		0.30983
δ = number of nondetect values/number of samples =		0.08571
z=z-score[(0.99-δ)/(1-δ)] =	z-score of 0.98906 =	2.299792

(from z-score calculator at http://www.fourmilab.ch/rpkp/experiments/analysis/zCalc.html)

Daily Max Limit = exp (u_y + z-score*σ_y)

Daily Max Limit = 23.24 mg/l
(Log normal distribution, 99th percentile)

Average Monthly Limit Derivation (some measurements < detection limit)

Number of samples per month, n =	3.04
E(x) = Daily Avg = $\delta D + (1-\delta) \exp(u_y + 0.5 \sigma_y^2)$ =	11.35863
V(x) = Daily Variance = $(1-\delta)\exp(2u_y + \sigma_y^2)[\exp(\sigma_y^2)-(1-\delta)] + \delta(1-\delta)D[D-2\exp(u_y + 0.5\sigma_y^2)]$ =	16.95584
A = $V(x)/[n(E(x)-\delta^n D)^2]$ =	0.043228831
B = $-[\delta^n D^2(1-\delta^n)]/(E(x)-\delta^n D)^2$ =	-0.000110144
C = $(2\delta^n D)/(E(x)-\delta^n D)$	0.000500595
σ_n^2 = Monthly Average variance = $\ln\{(1-\delta^n)[1+A+B+C]\}$	0.04213
σ_n = Monthly Average standard deviation = σ_n^2^(0.5) =	0.20525
u_n = n-day monthly average = $\ln[(E(x)-\delta^n D)/(1-\delta^n)] - 0.5\sigma_n^2$ =	2.40866
z=z-score[(0.95-δ)/(1-δ)] = z-score of 0.94531 =	1.61054

Monthly Average Limit = exp (u_n + z-score*σ_n)

Monthly Avg Limit = 15.47 mg/l
(Log normal distribution, 95th percentile of average monthly values)

Source: EPA 1991, *Technical Support Document for Water Quality-base Toxics Control,* Appendix E - Lognormal Distribution and Permit Limit Derivations, EPA/505/2-90-001

ATTACHMENT D

ANTI-DEGRADATION REVIEW AND DETERMINATION

NPDES Permit: MA0040207

ANTI- DEGRADATION REVIEW AND DETERMINATION

Proponent: Chang Farms, Inc.

Project: Proposed NPDES Permit MA0040207
Bean Sprout Cultivation Wastewater

Receiving Water: Connecticut River
Connecticut Watershed - MA34-04

Classification: Class B - Warm Water Fishery

Introduction

Chang Farms, located in Whately, MA, has submitted an application for a NPDES permit to the MADEP (the 'Department') and USEPA for the discharge of wastewater. The facility is an agricultural enterprise that produces bean sprouts in different varieties for the retail market. The proposed discharge is to the Connecticut River, adjacent to the facility. The following review and determination is based upon information submitted as part of NPDES application MA0040207, the USEPA permit draft fact sheet, effluent monitoring data from 2004 and a site visit conducted by the Department on March 29, 2005. This information is paraphrased in the following discussion without further reference.

Applicability

This discharge constitutes a "new discharge" (see 314 CMR 4.02) to a surface water of the Commonwealth. In accordance with 314 CMR 3.03, this discharge requires a NPDES/Surface Water Discharge Permit and is subject to a review and determination by the Department under the Antidegradation Provisions [314 CMR 4.04 (2)] of the Massachusetts Surface Water Quality Standards.

NPDES Permit History

The US EPA and the MA DEP jointly issued Chang Farms a NPDES permit to discharge process wastewater to the Sugarloaf Brook (which flows to the Connecticut River) from a bean sprout farming operation in the town of Whately, Massachusetts. This permit, MA0028851, was issued and effective on September 30, 1985. Chang Farms notified EPA on February 10, 1995 that it had ended discharge to Sugarloaf Brook and was discharging to the ground, on-site. EPA responded in a letter dated March 10, 1995, that because Chang Farms was no longer discharging to waters of the U.S. it was closing their NPDES permit. The facility currently discharges to the ground.

Proposed NPDES Discharge

Chang Farms submitted a NPDES permit application to the MADEP and the EPA, dated June 30, 2004, requesting to discharge to the Connecticut (CT) River. The NPDES permit application was approved as administratively complete by the EPA on April 27, 2005. Chang Farms application details the proposed discharge to the CT River of up to 180,000 gallons per day (GPD) of wastewater generated during sprout cultivation and harvesting, including wastewater from washing of the mature sprouts and associated handling equipment. The wastewater

contains E. coliform, Fecal coliform bacteria and low levels of suspended solids and BOD. Remaining wastewater constituents include applied nutrients, liquid acid equipment cleaners and sanitizers, liquid chlorinated alkaline foam cleaners and liquid phosphoric acid foam cleaners. A table of effluent characteristics is attached to this determination.

Chang Farms' consultant, The Dennis Group, has provided a report with specific bacterial effluent monitoring data. The EPA and the MA DEP have reviewed this report and other information relative to bean sprout production. A copy of the the report is provided as an attachment to the draft permit's fact sheet.

The applicant has agreed to install a UV disinfection system to ensure the discharge to the Connecticut River complies with Massachusetts water quality standards. Monitoring the discharge for chlorine residual will be required in the permit due to the occasional use of chlorine containing cleaning products at the facility. Any residual chlorine concentration present in the discharge will be minimized by the available detention time in the force main.

Technology-based Review
EPA has not promulgated effluent guidelines for bean sprout cultivation facilities. The draft NPDES permit for the Chang Farms facility in Whately, MA (MA0040207) was prepared based on Best Professional Judgement (BPJ).

Review of Antidegradation Qualification Provisions
Protection of Existing Uses - [314 CMR 4.04 (1)]
In all cases existing uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.

The Connecticut River at the point of discharge is classified as a Class B water body by the Massachusetts Surface Water Quality Standards 314 CMR 4.05(3)(b). The discharge will be within the limits for Class B waters and not impair existing water uses nor result in a level of water quality less than that specified for Class B water. To the maximum extent feasible, this discharge and activity are designed and conducted to minimize adverse impacts on water quality, including implementation of source reduction practices.

Protection of High Quality and Other Significant Resource Waters - [314 CMR 4.04 (2)]
Limited degradation may be allowed by the Department where it determines that a new or increased discharge is insignificant because it does not have the potential to impair any existing or designated water use and cause any significant lowering of water quality; also limited degradation may be allowed as provided in 314 CMR 4.04(4).

Based on a dilution factor of over 6,000:1, the proposed discharge to the Connecticut River provides significant dilution and does not have the potential to impair any existing or designated water use or cause any significant lowering of water quality. An analysis of the proposed discharge's mass loadings of BOD, TSS, phosphorus, nitrogen and bacteria, predict extremely low increases in the river concentrations of these parameters.

The discharge will maintain the resource, the receiving water, for its designated use, and the discharge will meet the conditions of 314 CMR 4.04(4).

Protection of Outstanding Resource Waters - [314 CMR 4.04(3)]

Not Applicable

Authorizations - [314 CMR 4.04 (4)]
(a) An authorization to discharge to waters designated for protection under 314 CMR 4.04(2) may be allowed by the Department where the applicant demonstrates that:

1. The discharge is necessary to accommodate important economic or social development in the area in which the waters are located;

The applicant, Chang Farms, Inc., maintains open farming space at this facility.

2. No less environmentally damaging alternative site for the activity, source for the disposal, or method of elimination of the discharge is reasonably available or feasible;

The Department recognizes four alternatives for management of the proposed permitted discharge flow ; 1. reuse of discharge for irrigation of crops., 2. discharge to ground with a groundwater discharge permit, 3. convey discharge to an existing publicly owned treatment facility (POTW) for treatment and discharge to the CT River and 4. provide treatment and discharge directly to the CT River. Option 1 and 2 are not possible, discharge to irrigation was used in the past and caused ponding due to restrictive soils and is potentially harmful to crops. Option 3, conveying the discharge to the South Deerfield POTW, is not possible at this time due to the current lack of hydraulic flow capacity at the POTW. Option 4, treatment and discharge to the CT River has been determined to be the most reasonable and sufficiently environmentally protective at this time. No less environmentally damaging alternative site for the activity, source for the disposal, or method of elimination of the discharge is reasonably available or feasible.

3. To the maximum extent feasible, the discharge and activity are designed and conducted to minimize adverse impacts on water quality, including implementation of source reduction practices; and

The applicant proposes to install a UV disinfection system in order for the discharge to meet Class B waters standards. The draft NPDES permit also includes the requirement that the permittee prepare and implement a "Best Management Practices (BMPs) Plan" to be followed in operating the facility to identify and describe operational practices which specifically target the minimization of the discharge of nitrogen compounds and which minimize, in general, the amounts of pollutants (biological and chemical) discharged to receiving surface waters.

4. The discharge will not impair existing water uses nor result in a level of water quality less than that specified for the Class.

The effluent characteristics of the proposed discharge, described in the attachment to this

determination, will not impair the Connecticut River's use as a Class B water, cause aesthetically objectionable conditions nor impair the benthic biota. To the maximum extent feasible, this discharge and activity are designed and conducted to minimize adverse impacts on water quality.

Determination

The Department has determined that the proposed discharge meets the requirements of the Anti-degradation provisions of the Massachusetts Surface Water Quality Standards and complies with the policy document (Anti-degradation Review Procedure for Discharge Requiring a Permit under 314 CMR 3.03: 1993 revised), which guides the review and implementation of these provisions. The Department has determined that this new discharge does not have the potential to impair existing or designated uses or cause any significant lowering of water quality and is therefore 'insignificant' [as provided in 314 CMR 4.04(2)]. The Department hereby approves the NPDES discharge permit and has determined that the discharge will be in compliance with the Massachusetts Surface Water Quality Standards and complies with the Anti-degradation requirements contained in 314 CMR 4.04.

Signed: _____ Date: 8/18/06

Glenn Haas, Director
Division of Watershed Management
Massachusetts Department of Environmental Protection

Chang Farms Wastewater Discharge - Effluent Data July 2004 - November 2004

SAMPLE DATE	Daily Flow	Coliform Bacteria		pH	BOD	Total Suspended Solids	Total Phosphorus	Total Nitrogen	Total Residual Chlorine
		Fecal Coli	E. Coli						
	GPD	col/100 ml	col/100ml	s.u.	Mg/l	mg/l	mg/l	mg/l	mg/l
7/8/04	100,000	5,800	---	Range 6.6 to 7.1	140	6	3	9.9	ND
7/15/04	100,000	TNTC	---		360	9	20	11	ND
7/22/04	86,000	<10	---		13	8	6	10	ND
8/12/04	107,000	180, 000	<2,000		15	10	3	11	0.16
8/19/04	102,000	64,000	9,000		12	9	6	11	ND
8/26/04	90,000	20,000	9,000		12	9	5.8	10	ND
9/2/04	95,000	90,000	50,000		14	7	10	11	ND
9/9/04	79,000	35,000	<1000		18	8	1	11	ND
9/16/04	90,000	310,000	290,000		17	13	2	11	ND
9/23/04	90,000	17,000	<1000		19.0	13	4.8	11	0.10
10/7/04	105,000	18,000	<1000		14	10	2.9	12	ND
10/14/04	100,000	<1000	<1000		15	10	4	11.0	ND
10/21/04	100,000	34,000	0		24	16	3	11	0.20
10/28/04	90,000	<1000	19		15	11	1.6	13	0.72
11/4/04	107,000	14,000	0		19	8	2.9	13	0.51
11/11/04	151,000	6,000	0		12.0	9.0	0.9	12	0.27
11/18/04	69,000	15,000	19		17	11	1.7	12	0.81
AVERAGES	97,706	55,011	26,003		43	10	5	11	0.15

Notes: Data from monitoring as required by MA DEP Consent Order.
Peak flows during the review period were 200,000 GPD on 10/17/2004 and 11/14/2004.

ND = not detectable